THE MICRODISTRIBUTION OF THE FRESHWATER SHRIMP *PARATYA CURVIROSTRIS* (DECAPODA : ATYIDAE) IN SALTWATER CREEK, NORTH CANTERBURY

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ABSTRACT

An attempt was made to account for the irregular microdistribution of *Paratya curvirostris* in Saltwater Creek, North Canterbury ($172^{o}42'E$, $43^{o}16'S$). Microdistribution could not be explained adequately by any of the variables measured, that is, current speed, depth and width of the marginal fringe of vegetation. However, a significant relationship was found between plant species and numbers of shrimps recorded at each station. Differences in closeness of packing of stems in different plants may have an important influence on microdistribution.

INTRODUCTION

During a study of the biology and ecology of the freshwater shrimp *Paratya curvirostris* (Heller, 1862) (Decapoda: Atyidae) in three North Canterbury streams (Carpenter 1976) I found that the microdistribution of shrimps was very irregular. An attempt was made to determine some of the environmental factors which bring about this irregular distribution by carrying out a field experiment in one of the streams, Saltwater Creek. An account of the experiment is given in this paper. The only other microdistribution study of a shrimp in freshwater was carried out in Tasmania by Walker (1972) on *Paratya australiensis* (Kemp 1917).

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METHODS

Field work was carried out on 20 January 1976 along the southern bank of Saltwater Creek (172°42'E, 43°16'S), immediately below Hanna's Bridge. Fifty-one samples were taken at 2 m intervals using a 0.3m diameter hoop net of 198μm mesh. The net was drawn once from the edge of the fringe*, at right angles to the bank, straight to the bank. Samples were preserved in 5 - 10% formalin. Sampling stations were far enough apart so that sampling at one site did not disturb animals at the next.

Current speed was measured with a Gurley No. 625 Pygmy current meter, as close to the bank as possible without weed interfering with its operation. The width, depth and species composition of the fringe were all recorded. In the laboratory, shrimps were sorted from the samples, sexed, and their carapace lengths were measured.

Numerical data obtained were analysed using an I.B.M. programme adapted for use in a Burroughs 6700 computer. It produced a matrix of partial correlation coefficients and did stepwise multiple regression analyses of the population variables (total numbers, numbers of females, mean size of shrimps) against the habitat variables (fringe width and depth, and current speed). The mean number of shrimps and the mean number of female shrimps associated with each species of plant were determined and compared using Student's t test.

RESULTS AND DISCUSSION

All multiple regression equations were non-significant, indicating that neither the total number of shrimps, the number of females, the percentage of females in samples nor the mean size of shrimps was correlated significantly with a combination of current speed, fringe width and depth.

The partial correlation matrix is shown in Table 1. It contains seven statistically significant correlations.

The biological significance of these results is difficult to interpret. The relationship between total numbers of shrimps and depth may be due to the amount of habitat available per unit length of stream bank being greater in deeper water. Subjectively, the depth of fringe usually appeared to be greater when the depth of water was greater, although it is difficult to say why this is so. Mean shrimp size also was positively related to both the depth and fringe width, and again this possibly is a function of volume of habitat.

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*The term fringe was used by Carpenter (1976) to describe the plant community in lowland streams, typified by plants such as *Agrostis stolonifera* and *Mimulus guttatus*, that are rooted on the bank and grow out across the water.

TABLE 1. PARTIAL CORRELATION MATRIX OF MICRODISTRIBUTION DATA.

*P is less than 0.05, **P is less than 0.01, N.A. = not applicable.

	Mean carapace length	Width of fringe	Depth	Current
Population variables:				
Total numbers	0.110	0.215	0.649**	-0.150
Number of females	-0.469**	-0.214	-0.286*	-0.097
Per cent females	0.237	0.112	0.160	0.305*
Mean size	N.A.	0.279*	0.289**	-0.009
Habitat variables:				
Width of fringe	0.279*	N.A.	0.588**	-0.250
Depth	0.144	0.588**	N.A.	-0.0407
Current	-0.009	-0.250	-0.0407	N.A.

More females were found in shallower water, and as mean shrimp size increased fewer females were found. This suggests that females avoid large concentrations of shrimps and large shrimps, and again there are no obvious reasons for this. The percentage of females in the population was higher when current speed was faster; moving water possibly assists cleaning and oxygenation of eggs.

There were six common plant species in the study area, and six sampling sites with no macrophytes. The mean number of shrimps at sites with each (or no) plant species fell into four groups, all significantly different (P is less than 0.05, students t test). Most shrimps were associated with *Veronica americana* , fewer with *Agrostis stolonifera* and *Alopecurus pratensis* , fewer still with *Holcus lanatus* and *Mimulus guttatus* , and least with *Nasturtium officianale* and where there were no macrophytes at all.

The relationships between numbers of females and plant species was assessed in the same way, but with different results. The seven attributes fell into three groups: most females were found amongst *Alopecurus pratensis* , least where there were no macrophytes at all, but similar numbers were found associated with the other five plants.

These results suggest that one of the main factors affecting microdistribution was the plant species present. It is also likely that the correlations observed between shrimp distribution and factors such as depth and current were a function of the effect of the physical attributes of the stream on the type and structure of the fringe, i.e. the relationship between physical factors and shrimps is a function of the fringe's relationship to both. It should be informative to extend this type of study by using more stations and more than one stream (as the fringe varies along and between streams).

Walker (1972) studied the microdistribution of *Paratya australiensis* in a Tasmanian stream, and found that different sized shrimps had different preferred habitats. He related the size of the animal with its ability to move through the spaces between stems and stolons of the macrophytes and concluded that the major factor influencing microdistribution was the species and structure of the macrophytes. For example, dense beds of *Myriophyllum elatinoides* contained few or no shrimps, but shrimps were common in beds that were less dense. In Saltwater Creek, there appeared to be considerable differences in the closeness of packing of stems of the six plant species found and the microdistribution of shrimps therefore is probably related to this.

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